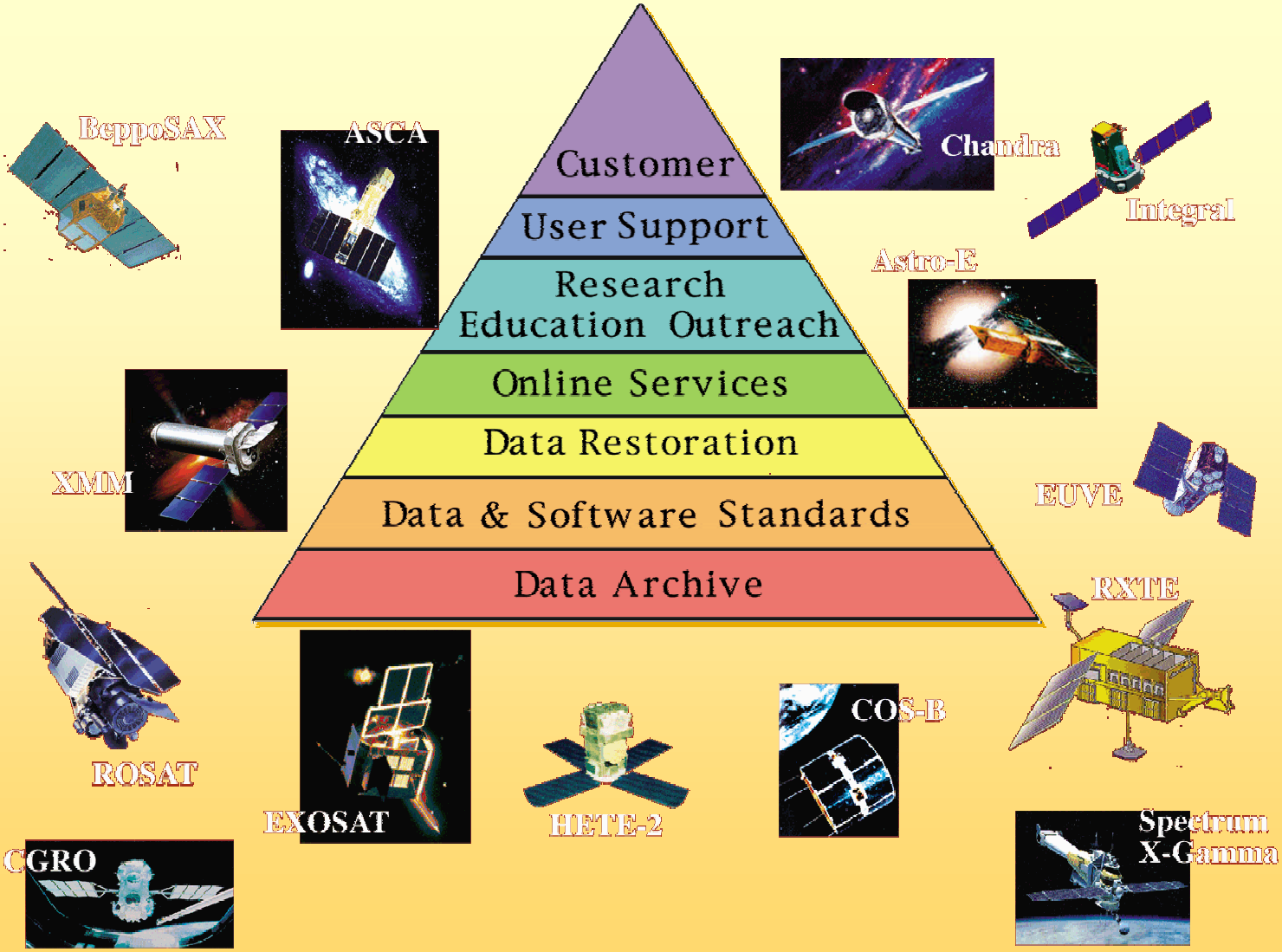
The HEASARC

Established December 1990

The HEASARC Charter:

- Maintain and disseminate data from previous and concurrent high-energy astrophysics missions
- Provide software and data analysis support for these data sets
- Maintain and provide the necessary scientific and technical expertise for the processing and interpretation of the data holding
- Develop and maintain multi-mission analysis and support tools
- Provide catalogs of observations and ancillary information for the data holdings
- Coordinate data, software, and media standards with other astrophysics sites.

Active Mission Support



The Physical Archive

Past Missions

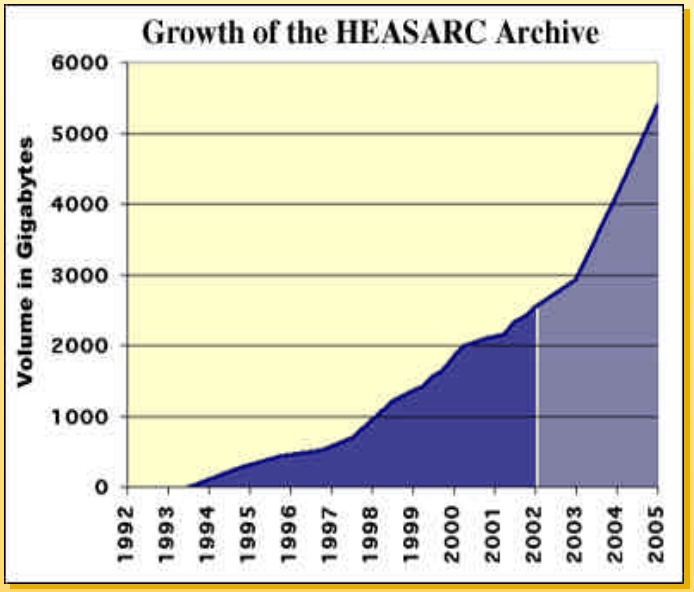
Ariel 5
ASCA
BBXRT
CGRO
Copernicus
COS B
DXS
Einstein
EUVE
EXOSAT
Ginga
HEAO 1
HEAO 3
OSO 8
ROSAT
SAS 2
SAS 3
Vela 5B

Active Missions

RXTE (1995-)
BeppoSAX (1997-)
Chandra (1999-) [data at CXC]
XMM-Newton (1999-)
HETE-II (2000-)

Upcoming Missions

Integral (2002 Launch)
Swift (2003 Launch)
GLAST (2006 Launch)



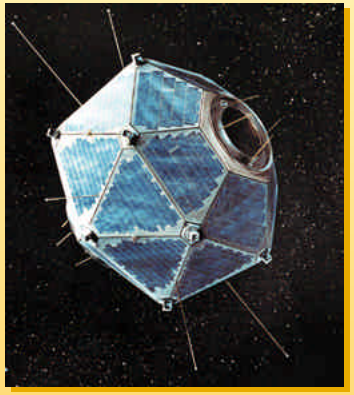
- Data from 25 missions currently in the archive
- About 280 astronomical catalogs & mission tables
- The archive volume was 2500 Gigabytes as of the end of 2001

Data Restoration

HEASARC Data Holdings as of March 19, 2001

Mission	Instr.	Raw Data	FITS Raw Data	FITS Products	GIF Products	Calibration	Analysis Software	Data Volume (Gbytes)	Complete?
BeppoSAX								40.3	no
Chandra									no
RXTE								833.9	no
XMM-Newton								2.0	no
Ariel V	ASM							< 1.0	yes
	SSI								
ASCA								536.1	no
BBXRT								1.3	yes
CGRO								194.6	no
Copernicus								< 1.0	yes
COS-B								< 1.0	yes
DXS								< 1.0	yes
Einstein								15.3	yes
EUVE								42.2	no
EXOSAT	LE							105.6	yes
	ME								no
	GSPC								yes
Ginga								19.8	yes
HEAO-1	A1							< 1.0	yes
	A2							2.7	yes
	A3							6.1	yes
	A4							< 1.0	yes
HEAO-3								5.7	yes
OSO-8								6.5	yes
ROSAT								119.2	no
SAS-2								< 1.0	yes
SAS-3								7.1	yes
Vela-5B								5.6	yes

Complete	Partially Available	Work in Progress	Continually Updated	External Archive



The HEASARC Web

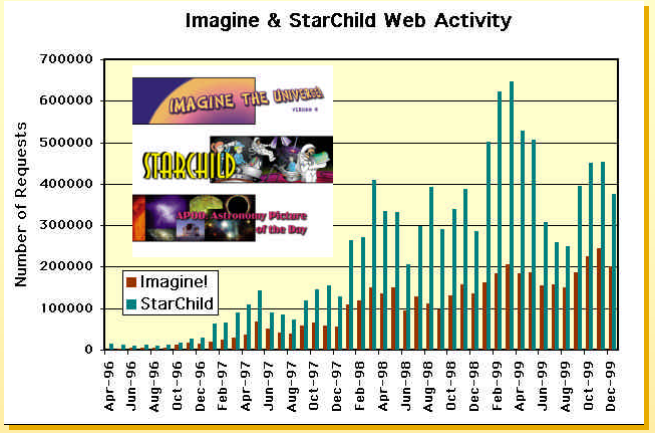
Assist astrophysicists in all stages of their archival research:

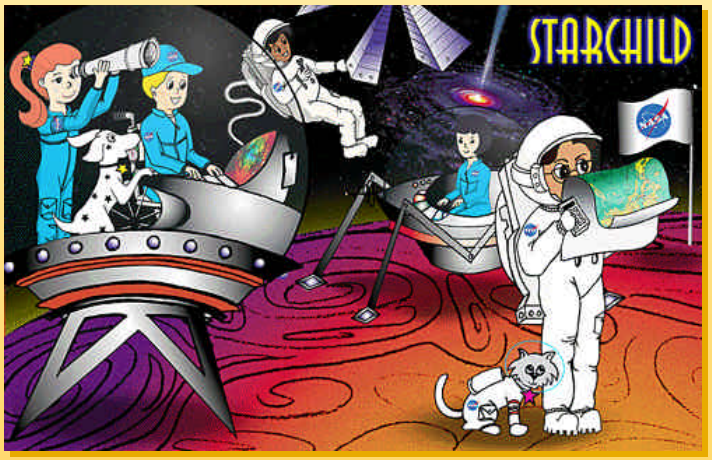
- Information and latest news about HEASARC Catalogs
- Mission information
- Search catalogs & retrieve data
- Download analysis software
- Access documentation
- Astronomical Web site links
- Public outreach & education

Education & Public Outreach

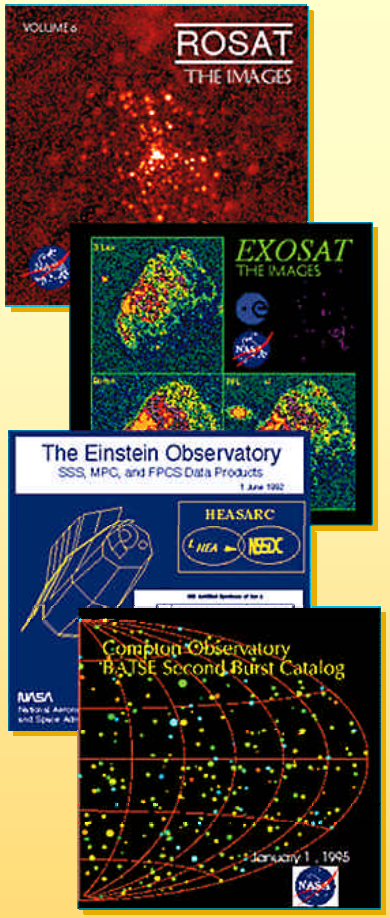
A service of the High Energy Astrophysics Learning Center
http://imagine.gsfc.nasa.gov/

- Multi-level discussion of astronomy
- Lesson plans using actual satellite data
- CD-ROM's, posters, support teacher conferences
- Created by HEASARC scientists and programmers collaborating with teachers
- NCTM and NSTS standards listed
- Ask A High Energy Astronomer service





HEASARC CD-ROM's



The HEASARC publishes CD-ROM's containing selections of important data products (images, spectra, and light curves).

Thirteen CDs have been published for a variety of high-energy astrophysics missions (CGRO, ROSAT, EXOSAT, and Einstein.

CD-ROM's contain URL links directly back to the data archives at the HEASARC.

CD-ROM's are distributed by the HEASARC at AAS and other astronomical meetings, and are also available free of charge on request.

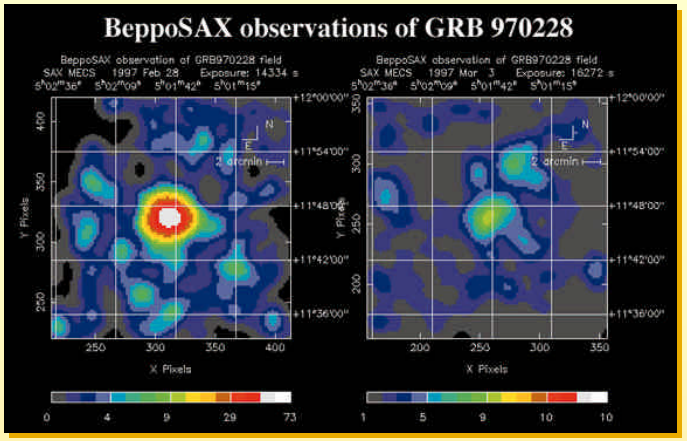
Software: Ftools & Xanadu

FTOOLS is a general software package which can manipulate any type of FITS files, and can do selection, analysis, and other scientifically useful tasks on FITS files from high-energy astrophysics missions. Currently supported missions include ASCA, ASTRO-E, CGRO, Einstein, EXOSAT, OSO-8, ROSAT, RXTE, and Vela 5B.

XANADU is a software package comprising high-level programs for spectral (XSPEC), timing (XRONOS), and imaging (XIMAGE) analysis of X-ray and gamma-ray astronomy data files.

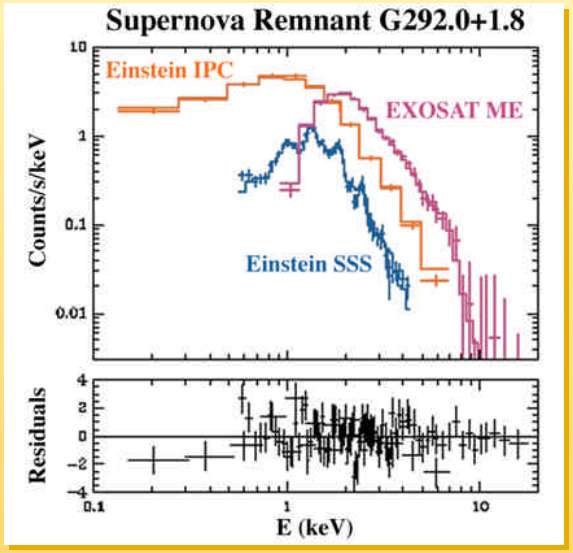
In early 2000, FTOOLS and XANADU will work in an integrated common environment and be distributed (either together or separately, according to the user's requirement) on a common release schedule.

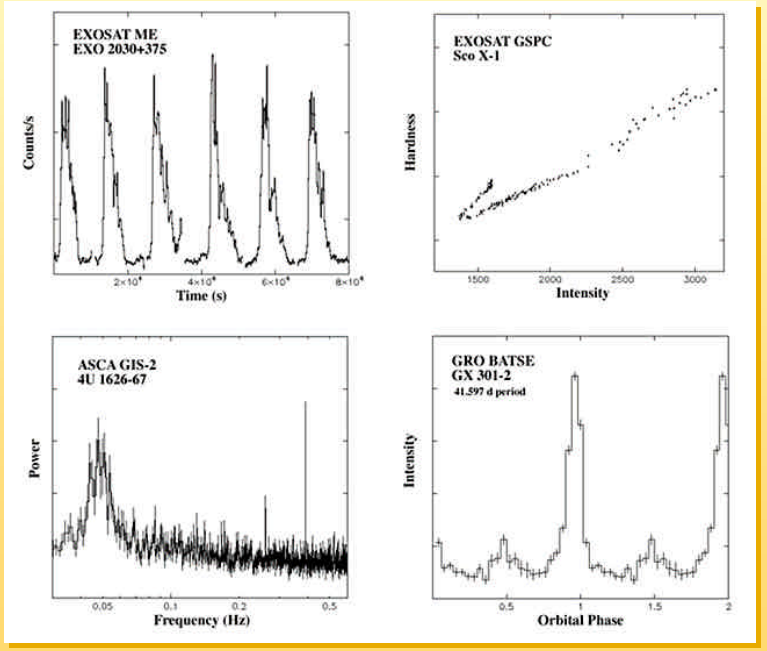
Software: Xanadu



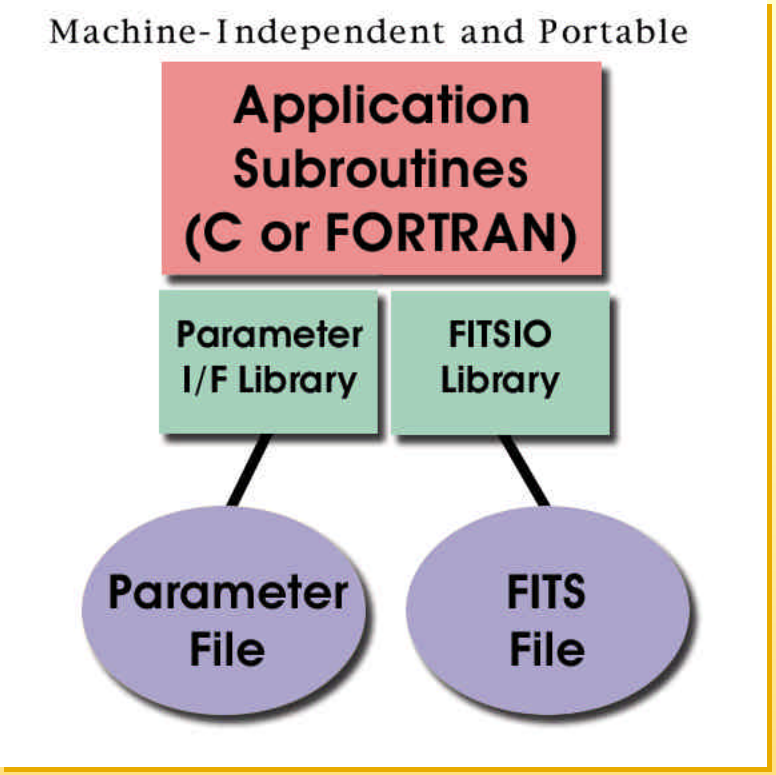
Multi-mission analysis software

- Spectral analysis: XSPEC
- Timing analysis: XRONOS
- Image analysis: XIMAGE





Software: F tools



All code written in ANSI standard C or FORTRAN. Machine-independent and portable.

All data input/output is in the form of FITS files via the CFITSIO subroutine interface, or occasionally, ASCII files.

All user input to the task is done via a parameter file.

Data Format Standards

Sample FITS File

```
XTENSION= 'BINTABLE'           /  FITS BINARY TABLE
BITPIX  =                    8 /  Binary data
NAXIS   =                    2 /  Table is a matrix
   :
   :
   :
EXTNAME = 'EVENTS  '           /  Table name
TTYPE1  = 'TIME    '           /  Label for 1st column
TFORM1  = '1D      '           /  Data type: Double precision
TTYPE2  = 'RAWX    '           /  Label for 2nd column
TFORM2  = '1I      '           /  Data type: Short integer
```

TIME	RAWX	RAWY	DETX	DETY	X	Y	PHA
24305.2	18	25	19	25	235	344	4
24306.9	211	79	213	78	874	514	7
.....	...	...	...	...	....	....	..
.....	...	...	...	...	....	....	..
.....	...	...	...	...	....	....	..
.....	...	...	...	...	....	....	..

The HEASARC develops, coordinates and promotes standardized FITS formats for use within the High-Energy Astrophysics community.

These standards allow multi-mission analysis packages and encourage recycling of software at considerable cost savings.

The HEASARC publishes these standards on the Web and in its journal, *Legacy*. It also collaborates with new missions to ensure that their data products conform to these standards.

The HEASARC Customers

The HEASARC has 4 groups of users:

- Investigators selected to use the ASCA, ASTRO-E, BeppoSAX, CGRO, ROSAT, and RXTE observatories which include scientists
  - at US universities
  - at NASA's GSFC and other government labs
  - from around the world
- Archival researchers
- The general public, who are interested in what NASA is doing
- Teachers, parents, and school children for education and outreach

Usage & Data Statistics

Gigabytes (GB) transferred by ftp per year:

1998	1999	2000	2001
842 GB	1391 GB	1846 GB	2251 GB

Gigabytes (GB) transferred by the www (http) per year:

1998	1999	2000	2001
424 GB	603 GB	1083 GB	1428 GB